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(54) **METHOD AND APPARATUS FOR DETERMINING COUPLING SECTION IN REAL-TIME FOR TRAIN PLATOONING**

(57) The present disclosure provides a method and apparatus for determining coupling and decoupling positions between trains. In at least one embodiment, the present disclosure provides a method performed by an apparatus for determining coupling and decoupling po-

sitions between trains, the method comprising collecting performance data, simulation data, and real-time data, calculating a first parameter and a second parameter, and determining the coupling and decoupling positions between the trains.

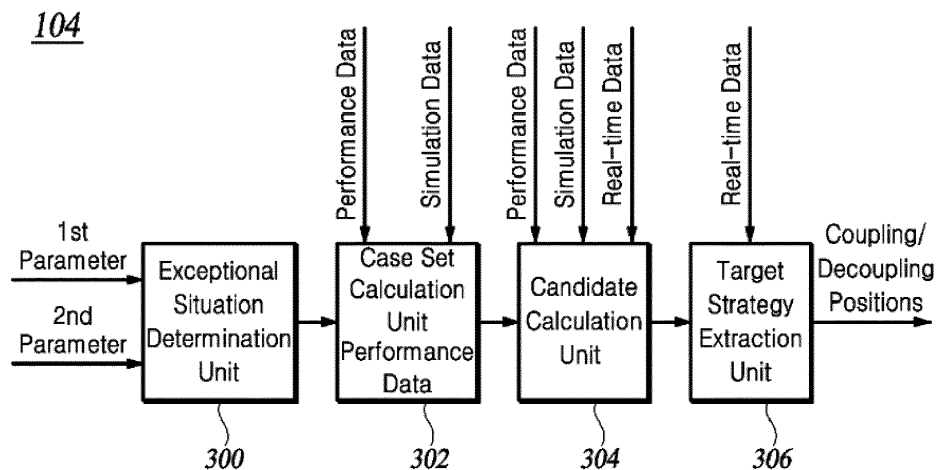


FIG. 3



EUROPEAN SEARCH REPORT

Application Number

EP 22 17 7971

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2018/079436 A1 (FIFIELD ROBERT W [US]) 22 March 2018 (2018-03-22) * paragraph [0002] - paragraph [0062]; figures 1-10 *	1-9	INV. B61L25/02 B61L27/16 B61L27/40
X	EP 3 437 957 A1 (MITSUBISHI ELECTRIC CORP [JP]) 6 February 2019 (2019-02-06) * paragraph [0002] - paragraph [0127]; figures 1-8 *	1-9	
A	EP 3 437 955 A1 (HITACHI LTD [JP]) 6 February 2019 (2019-02-06) * paragraph [0002] - paragraph [0053]; figures 1-16 *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			B61L
<p>The present search report has been drawn up for all claims</p>			
Place of search		Date of completion of the search	Examiner
The Hague		27 November 2022	Kassner, Holger
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			



Application Number

EP 22 17 7971

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-9

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION SHEET B

Application Number

EP 22 17 7971

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-9

A method performed by an apparatus for determining coupling and decoupling positions between trains, the method comprising:collecting, by the apparatus, performance data on operation performance and dispatch performance of a train, simulation data on a situation not recorded in the performance data on operation performance and dispatch performance of the train, and real-time data on passenger information and train operation information recorded in real-time;calculating, by the apparatus, a first parameter for determining whether a train is saturated and a second parameter for determining whether a railway traffic condition corresponds to an exceptional circumstance by using at least one of the performance data, the simulation data, the real-time data, and schedule data that is preset on operation and dispatch of the train; anddetermining, by the apparatus, the coupling and decoupling positions between the trains based on the first parameter and the second parameter.

2. claims: 10-15

A method performed by an apparatus for determining a coupling position between trains, the method comprising:calculating, by the apparatus, real-time estimation data including an estimated arrival time at which at least one train is expected to arrive at a joint station and a delay estimation value of the train by using simulation input data that is pre-stored;classifying, by the apparatus, a present situation into a normal circumstance or an exceptional circumstance by comparing the real-time estimation data with at least one exceptional circumstance threshold for determining an exceptional circumstance;determining a preceding train and a following train by a comparison of estimated arrival times between a first train that is planned to enter the joint station first according to an operation schedule and a second train that is planned to enter the joint station subsequently and couple with the first train according to the operation schedule;determining a preceding-train departure time for the preceding train to depart from the joint station by using a delay estimation value of the following train; anddetermining the coupling position between the preceding train and the following train to start platooning.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 7971

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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